

**Structure of the Eye** Figure 4.2 shows a top view of the eye if the eye were cut in half and the top taken off. The **cornea** (KOR-nee-ah) is a clear outer covering, behind which is a fluid. If you look at your eyes in a mirror, they seem shiny because you are seeing a reflection from the fluid behind the cornea. Next comes the portion of the eyes that lovers focus on. It is called the **iris** (EYE-ris) and is actually a colored circular muscle that opens and closes into larger or smaller circles in order to control the amount of light getting into the eye. To see it in operation, face a mirror, cover one eye, and turn on the light.

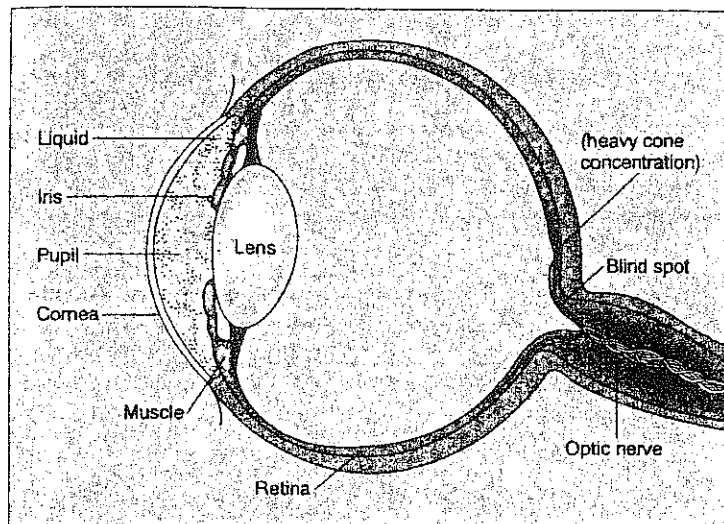


Figure 4.2 Cross section of the eye as seen from the top.

Stand so that the light will hit the covered eye when you remove your hand. Remove your hand, and watch how the iris, which had opened because it was dark behind your hand, quickly closes to a very small circle. When you leave a movie matinee, your irises are wide open to catch the limited light in the darkened theater; as you walk out into the sun, the light seems blinding at first because the irises aren't able to close fast enough; they let in too much light to too many receptors.

The **lens** of your eye is very much like a camera lens; it helps you to focus the objects you see onto the back of the eye where there are receptors. If the lens is not shaped correctly, the image coming in will either overshoot or fall short of the receptors at the back of the eye, and this causes images to blur. Eyeglasses are designed to change the angle at which the light hits the lens, causing the incoming light waves to land properly on the receptors. The lens automatically adjusts to whatever object we want to see. As the muscles controlling the lens make the adjustment, they give the brain information about how much they have moved, and this is one way we learn to judge how far away from us an object is.

What is the black circle in the middle of your eye? Nothing. The **pupil**, as you can see in Figure 4.2, is just an opening that changes size as the iris muscles move to cover and uncover the lens. Since it is dark inside your eye, the opening of the pupil looks black, but if you flash a light inside, the colors coming back through the pupil can vary across the whole range, depending on how the light is bent and what it hits in there.

Psychological factors can control the iris muscles and thus the size of the pupil. The pupils of our eyes get smaller if we see something unpleasant; they get larger if we see something we really like (Millodot, 1982). Those who learn this think they might be onto something. Since the pupils enlarge if someone likes you a lot, checking out pupils may be a way to make sure. In fact, years and years ago about the only way most women could survive was to marry someone. If they found a desirable male, they would put a few drops of medicine made from a poisonous plant called *belladonna* into their eyes, causing the pupils to widen. The women couldn't see very well until it wore off, but long before science, nature knew what wide pupils meant, and the men began to fall in love, not quite knowing why. *Belladonna* means "beautiful lady." Lest you go off thinking this is foolproof, best to tell you that the pupils open up all the way when someone is *afraid* also, because this makes it possible to explore the threat in the environment better.

The light entering the eye gets to the back of the eyeball and hits the **retina** (RET-in-ah). Millions upon millions of receptors are embedded in the retina. We will discuss them in a moment. Before leaving the overall structure of the eyeball, note in Figures 4.2 and 4.3 that there is a place where all the nerve cells leave the eye in what's called the **optic nerve**. Retinal receptors are to the right and left of this point, but there are none where this nerve bundle leaves. This is called the **blind spot**. We can't see anything when light waves hit that point. Still, the eyes dart back and forth so rapidly that we normally never notice it.

**Receptors in the Retina** Go outside as twilight approaches. Take a chair, a blue object, and a red object (or go where there are some blue and some red flowers). Sit in the chair, put the objects down,

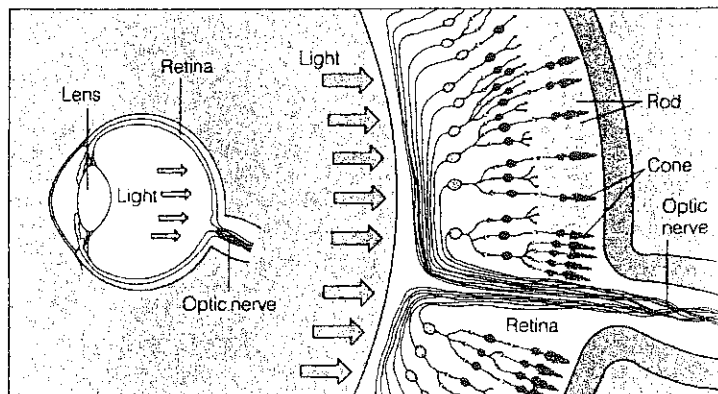


Figure 4.3 Rods and cones transmitting impulses through the optic nerve.

and watch them as darkness approaches. The red objects will soon turn black and disappear, but the blue objects will not turn black until it is almost completely dark outside.

What you are experiencing is the fact that the retina is made up of two different kinds of receptors. The first type of receptor is called a **rod** because it is shaped like one (see photograph above). The second is called a **cone** because that's the shape it has. Rods are very sensitive to the violet-purple range of wavelengths, but we will only "see" black and white with them because they have no color chemicals in them. There are about 100 million rods in the retina, and they are used for night vision because they respond very well to low levels of light. Since the rods are turning on as it darkens, they are keeping the blue objects visible. The cones are shutting off, so the red objects disappear. Thus, cones are used for color and daylight vision and respond best to wavelengths in the red range. They shut off at night. You can see color on a highway when you are driving through the city at night because the light level is almost as high as during the day. But if you watch carefully when you turn away from a populated area and drive down a dimly lit street, you will notice that the headlights hit

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